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## Hollingsworth joins *Nano Letters* editorial advisory board

Jennifer Hollingsworth (Center for Integrated Nanotechnologies, MPA-CINT) has been named to the editorial advisory board of *Nano Letters*.

Published by the American Chemical Society, the journal features articles on nanoscience and nanotechnology that include the merging of at least two different areas or disciplines. Editorial advisory board members are responsible for guiding the journal's content and strategic direction and serving as a liaison between the journal and the scientific community. Board members also write minireview or viewpoint articles, review manuscripts, and adjudicate in the case of conflicting reviews on manuscripts.



Hollingsworth's research focuses on understanding and harnessing nanomaterials. She studies solution-phase synthesis of novel functional nanomaterials using "materials by design" approaches and creates systems to understand and control fundamental optical and electronic properties within semiconductor nanomaterials. She has developed synthetic methods and nanomaterials, including solution-liquid-solid nanowire growth, nonblinking nanocrystal quantum dots, infrared emitting quantum dots, and hybrid semiconductor-metal nanostructures. Hollingsworth, who joined the Laboratory in 1999 as a Director's Funded Postdoctoral Fellow after completing her PhD at Washington University in St. Louis, is a fellow of the American Association for the Advancement of Science and Los Alamos National Laboratory. ■

*Technical contact: Jennifer Hollingsworth*

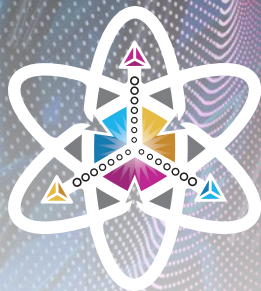
## Los Alamos expertise tapped for how to build the essential resonant ultrasound spectrometer

Resonant ultrasound spectroscopy (RUS) is an essential tool for researchers seeking to measure materials properties affected by elasticity. RUS can be exceptionally effective in observing the change in fundamental thermodynamic susceptibilities with part-per million resolution. For example, RUS provided thermodynamic evidence for the pseudogap in novel superconductors and helped understanding the nature of plutonium and its alloys and how they age.

The editors of *Review of Scientific Instruments* recently invited Los Alamos researchers to share their expertise in how to build a state-of-the-art RUS system and use it to characterize elastic properties of materials. Their work, "Resonant ultrasound spectroscopy: The essential toolbox," was featured on the cover of *RSI*.

RUS is a nondestructive ultrasound-based process that measures natural mechanical resonances in specimens as small as a fraction of a millimeter and uses them to compute all the components of the elastic modulus tensor. The ultrasonic resonances are determined

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“ *I have gathered from my interactions that it is clear that the people of MPA are dedicated to mission and committed to excellence.* ”

## From David's desk . . .

Four months ago, Leonardo Civale and I were asked to fill the role of acting deputy division leaders for MPA. Having been in Physics Division for my career up to then, my knowledge of Andrew and MPA was by reputation—a good reputation at that. Since then, I have had the pleasure of learning about the division, meeting some of its members, and working closely with the division office and group managers. I have gathered from my interactions that it is clear that the people of MPA are dedicated to mission and committed to excellence.

In the last several weeks the Lab has had to dramatically shift the way it does work to accommodate our current need to minimize the transmission of the novel coronavirus. To see how much we've shifted is amazing. Many LANL employees are working from home. Clearly there are challenges to maintaining this into the future, however, witnessing how quickly we've adapted to this point gives me confidence that we will be able to continue to adapt as we move forward. One thing should be clear, while certain activities are paused, there is every attempt to keep moving forward while staying safe. For example, MPA continues to hire. We recently brought on a new post-doc through the virtual onboarding process. Also, the work of the LANSCE Users Facility Director search committee, of which I am a member, has not slowed. We have adapted by interviewing candidates using WebEx and anticipate that the committee's work will be completed by the last week of April. A central challenge for group and division management is to facilitate as much work as can reasonably be accomplished while ensuring community safety. We continue to push the good ideas forward. They may take some time to be implemented, but keep bringing up new ideas with your colleagues and group and division management.

Being in the division office has also allowed me to have close interaction with those in the ALDPS office and has enhanced my appreciation for Toni and her staff's commitment to simultaneous excellence in the directorate. In the quest for simultaneous excellence I hope to be able to continue to contribute to MPA's success for throughout my tenure as acting deputy division leader. My WebEx office door is open. Feel free to reach out. ■

*Acting MPA Deputy Division Leader David Oro*



“*The technical independence and opportunities to engage in multidisciplinary research with people having a broad set of technical backgrounds make LANL a unique place to work.*”

## From Rajinder's desk . . .

In September, I marked my 10th year at LANL and transitioned into a half-time management position as deputy group leader for MPA-11. Writing my first “From the desk” article, I thought reflecting on my career path would make an interesting topic.

Some 20 years ago, while I was exploring career opportunities after completing undergraduate studies, pursuing a graduate degree in the United States seemed like a worthwhile option considering chemical engineering jobs were scarce in India. In graduate school, I was one of the few lucky foreign nationals who landed an industrial position even before my PhD thesis defense, which felt like a dream fulfilled. While working at Pall Corporation, I got involved in a project to evaluate commercial opportunities of LANL-developed polybenzimidazole (PBI) gas separation membranes in partnership with several large companies. This interaction carved my path to LANL and started my exciting scientific career.

Over the years at LANL, I have had opportunities to work on numerous materials development projects for applied energy and stockpile stewardship programs. Interestingly, PBI-based materials continue to play a key role in my team's (Carbon Capture and Separations for Energy Applications) research portfolio, with one current focus targeting commercialization of our recently developed industrial membrane platform. While striving to bring this exciting separation technology to market, we continue to explore PBI membrane materials development toward addressing other significant separation challenges, namely, air separations ( $O_2/N_2$ ) and water treatment.

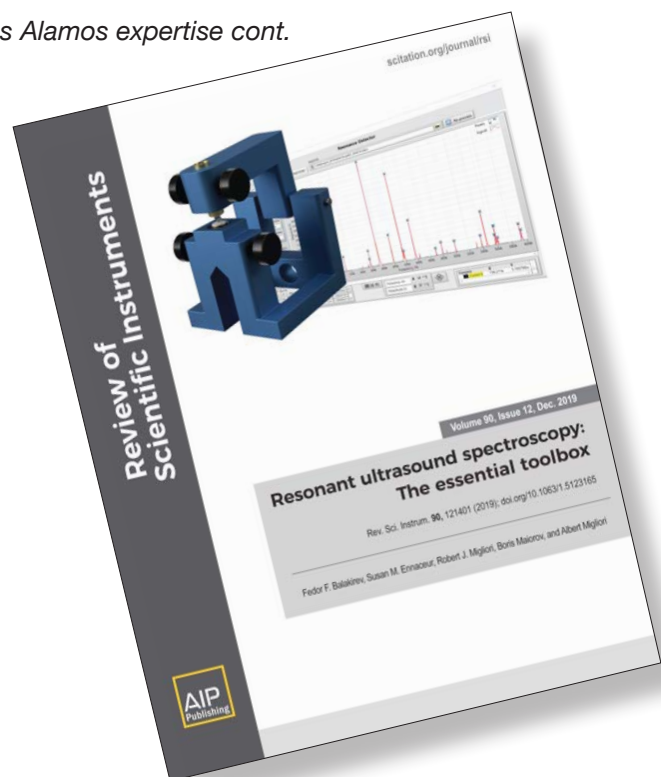
Over the years on a few occasions, I considered other opportunities both in academia and industry but always made the decision to stay at LANL. The technical independence and opportunities to engage in multidisciplinary research with people having a broad set of technical backgrounds make LANL a unique place to work. The competing priorities to draft successful proposals while chasing the elusive milestones for programmatic work can sometimes feel overwhelming yet are an exciting challenge of a LANL career. With numerous unsuccessful and a few successful proposals, I have realized that putting an idea on paper is well worth the exercise. Even if unsuccessful, the proposal writing and review process tremendously helps in developing a better understanding and building toward a successful idea. Embarking on the proposal writing journey well in advance of the submission deadline is a good strategy. An early start enables seeking critical review from peers, management, and program offices, which tremendously helps in building winning proposals.

Speaking of proposals, we just completed the LDRD pre-proposal phase. In this cycle, MPA-11 submitted 30 ER and 3 DR proposals in PI or co-PI role. Being an applied energy group, fuel cells, batteries, water treatment, electrocatalysis, electrolysis, and  $CO_2$  mitigation constituted a significant portion of the proposals pursued. Other areas of interest included scintillators, detectors, critical materials recovery, plutonium science, and acoustics diagnostics. This diverse range of topics covered in submitted proposals shows the impressive multidisciplinary MPA-11 capabilities and motivation of our staff members to solve tough scientific problems relevant to the world's current and immediate needs! ■

*MPA-11 Deputy Group Leader Rajinder Singh*



Los Alamos expertise cont.



by density and geometry of the sample as well as symmetry of the crystal and its fundamental elastic properties. Los Alamos scientists developed a comprehensive toolbox for ultrasound-based minimal-effort high-accuracy elastic modulus measurements.

Included in the article are references to open-source circuit diagrams and Los Alamos National Laboratory data acquisition software and detailed instructions and procedures for acquiring measurements, including a full mathematical explanation of how the analysis software extracts elastic moduli from resonances. These systems are being used by several groups at Los Alamos and elsewhere for both basic and applied research.

Reference: *Review of Scientific Instruments* 90, 121401 (2019).

Researchers: Fedor Balakirev and Boris Maiorov (National High Magnetic Field Laboratory-Pulsed Field Facility, MPA-MAGLAB), Albert Migliori (Materials Synthesis and Integrated Devices, MPA-11), Robert Miglioni (Instrumentation and Controls, AOT-IC), and Susan Ennaceur (MPA-11 and Alamo Creek Engineering, New Mexico).

Work at Los Alamos was supported by Science Campaigns 1 and 2 (LANL Program Managers Ray Tolar and Dana Datelbaum, respectively), by a grant from the National Science Foundation, and by the State of Florida. ■

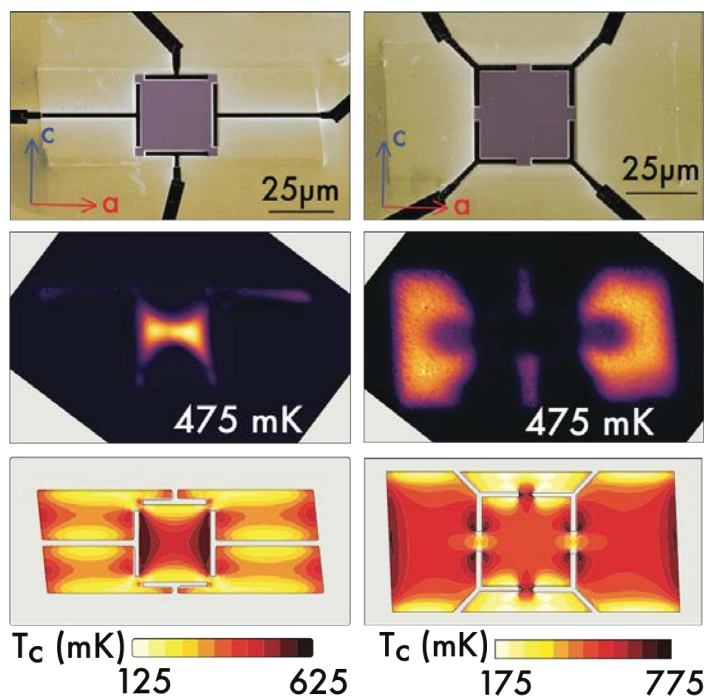
Technical contact: Fedor Balakirev

## Controllable spatial modulation of superconductivity

*Technique aids efforts to create materials with controlled functionality*

Heavy fermion superconductors have long been studied as model systems to understand the interplay between magnetism and superconductivity because their small energy scales allow researchers to cleanly tune the system's ground state using small perturbations. Recently, a team of researchers, which includes MPA scientists, exploited this sensitivity to demonstrate that a spatially modulated superconducting state could be achieved within a single crystal of the cerium-based heavy fermion superconductor,  $\text{CeIrIn}_5$ . Their technique, manipulating electronic order on micrometer-length scales, can be used in other strongly correlated materials and may enable fabrication of superconducting circuitry without physical junctions. The ability to create such devices has potential applications in quantum information science technologies and for the fundamental understanding of strongly correlated materials.

Typically, spatially modulated superconductivity is achieved through molecular beam epitaxy-grown heterostructures or alloying gradients, which have challenges to achieve transparent interfaces for superconducting electrons.



**Top:** False color SEM micrographs of two FIB defined microstructures. Trenches cut with the FIB appear as black regions. **Middle:** Scanning SQUID microscopy images identify superconductivity locally within the microstructure. Bright regions are superconducting. **Bottom:** Predicted maps of the local superconducting transition temperature from finite element method simulations of the FIB-induced strain field.

*continued on next page*

### Controllable cont.

Philip Moll and collaborators at the EPFL in Switzerland and the Technical University Dresden in Germany used focus ion beam (FIB) milling to create microstructured devices of single crystals grown by Eric Bauer (MPA-Quantum, MPA-Q). These microstructures could focus strain gradients across the device as a result of the differential thermal contraction between the substrate and the microstructure to modulate which portions of the sample become superconducting. Proof that this occurred was achieved by imaging and modeling performed by Katja Nowack's team at Cornell University. The beauty of this result is that the interface between the superconducting and normal regions are perfect by virtue of the fact that everything occurs within a single crystal.

This work lays the foundation upon which DOE-BES has created a new quantum information science project for the LANL, Cornell, and Lausanne team to explore the possibilities enabled by strain-controlled superconductivity in microstructured devices. The team envisions mounting a microstructured device on a tunable substrate, such as a piezoelectric, to enable a controllable superconducting switch. Even more ambitious, the team aims to create a tunable Josephson junction within a single material that could be used to make next generation qubits. Research on these microstructured devices is sure to uncover additional surprises with both fundamental and applied implications.

The work leverages Los Alamos's expertise in *f*-electron-based quantum materials.

Reference: M.D. Bachmann et al., "Spatial control of heavy-fermion superconductivity in  $\text{CeIrIn}_5$ " *Science*, 366, 221 (2019).

Los Alamos researchers: Ross McDonald (Center for Integrated Nanotechnologies, MPA-CINT), Laurel Winter (National High Magnetic Field Laboratory-Pulsed Field Facility, MPA-MAGLAB), and Eric Bauer and Filip Ronning (both MPA-Q). The work supports the Laboratory's Energy Security mission area and its Materials for the Future science pillar. Funding for the Los Alamos portion of the work was provided by the DOE, Office of Basic Energy Sciences, Division of Materials Sciences and Engineering. ■

Technical contact: Filip Ronning

### Celebrating service

Congratulations to the following MPA Division employees who recently celebrated a service anniversary:

Quinn McCulloch, MPA-CINT ..... 20 years  
Kevin Dudeck, MPA-11 ..... 15 years

## HeadsUP!

### REAL ID deadline extended a year

If you haven't gotten around to getting your REAL ID yet, good news: The deadline has been extended to Oct. 1, 2021.

That's a whole extra year to obtain a new license that will be in compliance with federal law.

#### What is REAL ID?

REAL ID is a federally mandated set of security-based standards for the issuance and acceptance of a driver's license. To obtain a REAL ID, you are required to go in person to the MVD to present a certain set of identity documents.

#### Why do I need a REAL ID?

You'll need a REAL ID if you intend to use your driver's license for official federal purposes (for example, obtaining a LANL-issued badge or traveling through a domestic airport).

Recent reports suggest nearly 2/3 of U.S. residents still need to obtain their REAL ID.

## MPA Materials Matter

Materials Physics and Applications

Published by the Physical Sciences Directorate.

To submit news items or for more information, contact Karen Kippen, ALDPS Communications, at 505-606-1822 or [aldps-comm@lanl.gov](mailto:aldps-comm@lanl.gov).

For past issues, see [www.lanl.gov/org/ddste/aldps/materials-physics-applications/materials-matter-archive.php](http://www.lanl.gov/org/ddste/aldps/materials-physics-applications/materials-matter-archive.php).



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